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Simultaneous Locomotion and Interaction in VR: Walking > Leaning > Controller

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Locomotion and 3D interaction are both critical for many Virtual Reality applications. However, prior research typically studied them in isolation, and there is surprisingly little research investigating interaction while moving - even though we can readily do that when physically walking. To address this gap, we designed a dual-task experimental paradigm (inspired by BeatSaber), which combines a maneuvering task (staying inside and rotating with a continuously moving virtual enclosure) with an interaction task (using the LightSaber to continuously point towards (“stab”) the center of upwards moving balloons appearing in 1sec intervals). We compared four locomotion conditions of decreasing amount of embodiment and proprioceptive/vestibular self-motion cues: Physical walking; hands-free standing leaning-based (Naviboard) and seated leaning-based (HeadJoystick) interface; and hand-held controller (thumbstick-velocity-control with controller-directed steering using their non-primary hand). Participants wore an HMD, used their primary hand for interaction, and physically rotated for all interfaces. As predicted, walking showed the highest performance in terms of locomotion score, interaction score, and combined dual-task score, whereas the hand-held controller performed worst. Using leaning did, however, show significant performance improvements over controller-based locomotion, even though participants always physically rotated. This performance benefit was more pronounced for the (arguable more embodied) standing leaning-based interface (NaviBoard) compared to the seated interface (HeadJoystick). Together, this suggests that more embodied leaning-based interfaces that provide at least minimal proprioceptive/vestibular translation cues in the direction of virtual self-motion can help to get us one step closer to the ease of natural walking when physical locomotion is unfeasible.

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